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NETWORK DEVICE CAPABLE OF CONTROLLING TRAFFIC

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a network device, and more particularly to a network device for controlling a switching device to determine rate limits for every port in association with a switching processor incapable of supporting a rate limit function, such that it can finely control traffic.

Description of the Related Art

With the increasing demands of various network applications (e.g., a network application based on the Internet, etc.), the demands of computer networks have also been increased. The most important devices for computer network communication are indicative of switching devices capable of processing the switching of communication packets. Traffic control operations for the switching devices are closely associated with communication network efficiency, and are also associated with accounting policies, such that they are very important matters in the switching devices.

Communication network enterprises provide subscribers or users with different fee lists, and assign different allowable

maximum traffic to individual subscribers or users according to the different fee lists. However, operations for temporally maintaining real switching traffic and a prescribed amount of traffic are not easily established due to irregular traffic exchange aspects.

As shown in Fig. 1, a typical network apparatus includes a switching processor 200 for switching packets communicated between computer terminals over a network according to individual ports, and a CPU (Central Processing Unit) 100 for controlling an overall system, and determining/controlling a variety of variables (e.g., traffic quantities of individual ports) required for normal operations of the switching processor 200.

The switching processor 200 includes a traffic controller 220, a few state registers having a packet counter register 250 or a traffic amount setup register 210, a physical layer connection unit 230, and a plurality of ports 240. The traffic controller 220 may also be called a port manager, controls the packet switching among the plurality of ports connected to the physical layer connection unit 230, and controls an amount of traffic of each of the ports.

The traffic controller 220 records the number of current switching packets in the packet counter register 250. The traffic controller 220 contained in the switching processor 200 for supporting high-performance functions controls an amount of

traffic within a predetermined range of a maximum traffic amount value for each port recorded in the traffic amount setup register 210.

The aforementioned operation for determining the amount of traffic according to individual ports in the switching processor 200 is typically called a rate limit operation. The switching processor 200 buffers packet traffic exceeding a predetermined rate limit in an internal Queue such that it performs a queuing process indicative of the delay of the packet traffic. Otherwise, in the worst case, the switching processor 200 abandons the switching of corresponding packet, and drops the same packet. This operation is called a drop process. If the packet traffic exceeds a predetermined capacity of Queue, the packet traffic must drop, such that a variety of problems due to the drop process of the packet traffic are encountered.

If important control packets for communication between terminals (e.g., packets associated with the session maintenance) drop, a new session must be initiated from the viewpoint of the terminals, such that real traffic unavoidably encounters a serious delay problem. The switching packet traffic measured by the applicant of the present invention causes very high fluctuation on the basis of a predetermined value in most switching devices, resulting in increased dissatisfied subscribers or users and deterioration of a QoS

(Quality of Service).

In the meantime, production companies of the switching processor capable of providing the rate limit function indicative of one of high-performance functions have predetermined traffic amount setup units (e.g., 8M unit) of ingress and egress for each port, such that end users or customers of the switching processor 200 cannot control the predetermined traffic amount setup unit to be reduced in a smaller unit (e.g., 1M unit) according to a variety of customer demands.

There is a second switching processor incapable of providing the rate limit function. However, a production company has predetermined one kind of an amount of traffic for each port of the second switching processor, the second switching processor has a disadvantage in that it cannot establish or adjust the amount of traffic in different ways according to a variety of customer demands.

In conclusion, the aforementioned network apparatuses can control the amount of traffic using only one hardware module called the switching processor, such that it is unable to freely and finely adjust the traffic according to a variety of customer demands.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a control structure of an amount of traffic for each port in a network apparatus such that it can be generally applied to the network apparatus irrespective of category information of a switching processor.

It is another object of the present invention to provide a network apparatus for finely determining an amount of traffic for each port in the range of a maximum value providable from a switching processor irrespective of specific information indicating whether the switching processor supports a rate limit function, such that it controls the amount of traffic.

In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a network device, comprising: a switching processor which includes a plurality of ports capable of being connected to a network line and a plurality of packet counter registers for controlling a packet switching operation among the ports and recording counting information of ingressing/egressing packets of each of the ports, and controls traffic process operations of the ingressing/egressing packets for every port according to a received traffic control command; and a controller which includes a switching controller for determining an amount of traffic for each port received from a

data entry unit to be a user value, registering the determined user value in a memory, reading a value of each packet counter register of the switching processor, comparing the read value with the user value for each port, and transmitting a traffic control command for the port to the switching processor according to the result of the comparison.

Therefore, the inventive network device can perform a generalized traffic control operation irrespective of standards of the switching processor.

Preferably the traffic control command may be determined to be one of queuing and drop commands of ingressing/egressing packets of a corresponding port.

Preferably, the controller further may include a generation source controller for reading the value of each packet counter register of the switching processor, comparing the read value with the user value for each port, and transmitting a command for limiting traffic of a generated packet to a traffic generation source of a corresponding port.

In accordance with features of the present invention, the present invention selects a low-level traffic control method basically selected by the switching processor, such that the ingressing/egressing traffic of individual ports can be properly controlled according to a predetermined amount of traffic of the controller, irrespective of category information of the switching processor.

An external CPU can control traffic simultaneously with continuously monitoring the switching processor according to a predetermined amount of traffic, such that the amount of traffic can be finely controlled.

A control microprocessor, instead of the switching processor, controls the traffic using a software program, such that a network production company can provide customers with an improved network device capable of controlling an amount of traffic in different ways according to the customer demands.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram illustrating a conventional network traffic control system; and

Fig. 2 is a block diagram illustrating a network traffic control device in accordance with a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, preferred embodiments of the present invention will

be described in detail with reference to the annexed drawings. In the drawings, the same or similar elements are denoted by the same reference numerals even though they are depicted in different drawings. In the following description, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear.

Fig. 2 is a block diagram illustrating a network traffic control device in accordance with a preferred embodiment of the present invention.

Referring to Fig. 2, a data entry unit 300 is indicative of a general data entry unit for receiving information indicative of an amount of traffic for each port from an administrator or manager. For example, the data entry unit 300 may be indicative of a keypad installed on the front panel of the network apparatus, or a keyboard port at which an external keyboard or mouse is connected. Egress and ingress traffic for each port is received from the data entry unit 300, the received egress and ingress traffic is determined to be a user value, and the determined user value is registered in a traffic amount setup area of a memory 410. The memory 410 and the following CPU 420 control the switching processor 500, and they are generally integrated into one chip.

In accordance with characteristic aspects of the present invention, the CPU 420 includes a switching controller 421 and

a generation source controller 423.

The switching controller 421 of the CPU 420 compares the user value for each port stored in the memory 410 with a value of a packet counter register 510 of a corresponding port, transmits a traffic control command for the corresponding port to the switching processor 500, and controls an amount of traffic for each port. For reference, the traffic control command is indicative of a control command for selecting one of queuing and drop processes of ingressing/egressing packets of the corresponding port.

The switching processor 500 for controlling an amount of traffic of each port upon receiving a control command from he controller 400 includes a packet counter register 510 for every port, a traffic controller 520, a physical layer connection unit 530, and a plurality of ports 540.

Each port 540 is adapted to connect a physical medium (i.e., a communication line) of the network to the switching processor 500. The packet counter register 510 for every port is adapted to indicate an amount of current ingressing/egressing packets of individual ports. An amount of packets of individual ports registered in the packet counter register 510 is read by the CPU 420.

The traffic controller 520 counts the number of ingressing/egressing packets of individual ports, and records the counted information in the packet counter register 510 for

every port. The traffic controller 520 controls amounts of ingressing/egressing packets of individual ports upon receiving a traffic control command from the switching controller 421. Such a counter register and a traffic control function are fundamental elements of the switching device. As stated above, representative traffic control methods are indicative of a drop process and a queuing process. For example, upon receiving a drop command for controlling an amount of traffic from the traffic controller 421 of the CPI 420, the traffic controller 520 drops packets exceeding the upper traffic limit of ingressing packets of a corresponding port. If the control command is equal to a queuing command, some packets exceeding the upper traffic limit from among a plurality of switching packets are buffered in a specific Queue, such that a process of the packets is delayed until the traffic is stabilized.

Finally, the physical layer connection unit 530 encodes data of a data link layer indicative of an upper layer, and exchanges the encoded data with a physical layer medium dependence (PMD) unit indicative of a lower layer.

Operations of the aforementioned network traffic control device will hereinafter be described.

Firstly, an administrator or user determines amounts of ingressing/egressing traffic of individual ports of the switching processor 500 using the data entry unit 300. In this case, the administrator can determine ingressing/egressing

traffic of individual ports in the range of maximum allowable traffic of individual ports. For example, a port number "1" is determined to be ingress 256M bits, and a port number "2" is determined to be 230M bits. In this manner, the setup unit of the ingressing/egressing traffic is reduced to a smaller setup unit as compared to the conventional switching processor, such that the administrator can finely determine user traffic according to his or her needs.

If an amount of the traffic of individual ports is determined, the determined traffic amount value is registered as a user value in a traffic amount setup area of the memory 410.

In the meantime, if packets are transmitted to individual ports according to a switching scheme over the switching processor 500, the traffic controller 520 counts the number of ingressing/egressing packets of individual ports, and records the counted number in the packet counter register 510 for every port. Therefore, the switching controller 421 of the CPU 420 reads the value recorded in the packet counter register 510, and compares the read value with the user value for each port, such that it can generate a control command capable of controlling an amount of traffic of each port according to the result of the comparison.

In accordance with another aspect of the present invention, the CPU 420 further includes a generation source

generator 423. The generation source controller 423 reads a value of the packet counter register 510 from the switching processor 500, compares the read value with a user value for each port, and transmits a request command for limiting traffic of a generated packet to a traffic generation source of a corresponding port according to the result of the comparison. The request command is typically called a flow control command, and includes a special format determined according to a communication protocol between network devices.

For example, if the amount of ingressing packet exceeds a user value, the generation source controller 423 directly transmits a flow control command to a corresponding port via the physical layer connection unit, and transmits a pause command to a counterpart terminal, such that the ingressing packet is temporarily halted.

For example, if an amount of a packet egressing in real time via any one port is higher than a predetermined user value, the switching controller 421 of the CPU 420 transmits a Queuing command to the traffic controller 520. Upon receipt of the Queuing command, the traffic controller 520 performs a Queuing operation for the egressing packet of the port in the allowable range of the memory, and adjusts the amount of traffic without generating the lost packet, such that it can satisfy a predetermined user-value range. If an amount of a packet ingressing from any one port in real time is higher than

the predetermined user-value range, the switching controller 421 of the CPU 420 generates a drop command, and the traffic controller 520 performs a packet drop operation.

If the counterpart terminal can analyze a pause command, the generation source controller 423 of the CPU 420 generates a control command to transmit a pause command to a counterpart terminal when the amount of the ingressing packet is higher than the user value. Therefore, the traffic controller 520 transmits a port command to a corresponding counterpart terminal, and adjusts the ingressing packet, such that an amount of packets can be adjusted without generating the lost packet.

In accordance with the present invention, a user or administrator sets an amount of traffic to a user value in the controller 400 using the data entry unit 300, and traffic of individual ports of the switching processor is controlled on the basis of the user value. Therefore, the present invention can support the rate limit function irrespective of the presence or absence of the support of the rate limit function, and a customer of the switching processor can directly divide a traffic unit into smaller traffic units such that the customer can directly manage the traffic of individual ports.

As apparent from the above description, the inventive network device depends on a software routine implemented in a

microprocessor freely programmed by a network production company, whereas the conventional network device fully depends on hardware of the switching processor selected for controlling traffic, it flexibly copes with various demands of a customer, such that a generalized traffic control is available.

The inventive network device allows the customer of the switching processor to freely determine traffic of individual ports controlled by the switching processor in such a way that traffic of individual ports can be controlled.

Furthermore, the inventive network device allows a switching processor incapable of supporting the rate limit function to freely determine traffic of individual ports in the range of a maximum value supportable by individual ports in such a way that the traffic can be efficiently controlled.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

WHAT IS CLAIMED IS:

1. A network device, comprising:

a switching processor which includes a plurality of ports capable of being connected to a network line and a plurality of packet counter registers for controlling a packet switching operation among the ports and recording counting information of ingressing/egressing packets of each of the ports, and controls traffic process operations of the ingressing/egressing packets for every port according to a received traffic control command; and

a controller which includes a switching controller for determining an amount of traffic for each port received from a data entry unit to be a user value, registering the determined user value in a memory, reading a value of each packet counter register of the switching processor, comparing the read value with the user value for each port, and transmitting a traffic control command for the port to the switching processor according to the result of the comparison.

2. The network device according to claim 1, wherein the traffic control command is determined to be one of queuing and drop commands of ingressing/egressing packets of a corresponding port.

3. The network device according to claim 2, wherein the controller further includes:

a generation source controller for reading the value of each packet counter register of the switching processor, comparing the read value with the user value for each port, and transmitting a command for limiting traffic of a generated packet to a traffic generation source of a corresponding port.

ABSTRACT OF THE DISCLOSURE

A network device capable of controlling traffic. The network device performs packet switching between ports, and determines a rate limit for each port even when a switching processor incapable of supporting a rate limit function, such that an amount of traffic can be controlled. The network device includes a switching processor and a switching controller. The switching processor includes a plurality of ports capable of being connected to a network line, and a plurality of packet counter registers for recording counting information of ingressing/egressing packets of individual ports, and controls traffic process operations of the ingressing/egressing packets of individual ports according to a received traffic control command. The switching controller determines an amount of traffic for each port received from a data entry unit to be a user value, registers the determined user value in a memory, reads a value of each packet counter register of the switching processor, compares the read value with the user value for each port, and transmits a traffic control command for the port to the switching processor according to the result of the comparison.

Fig.1

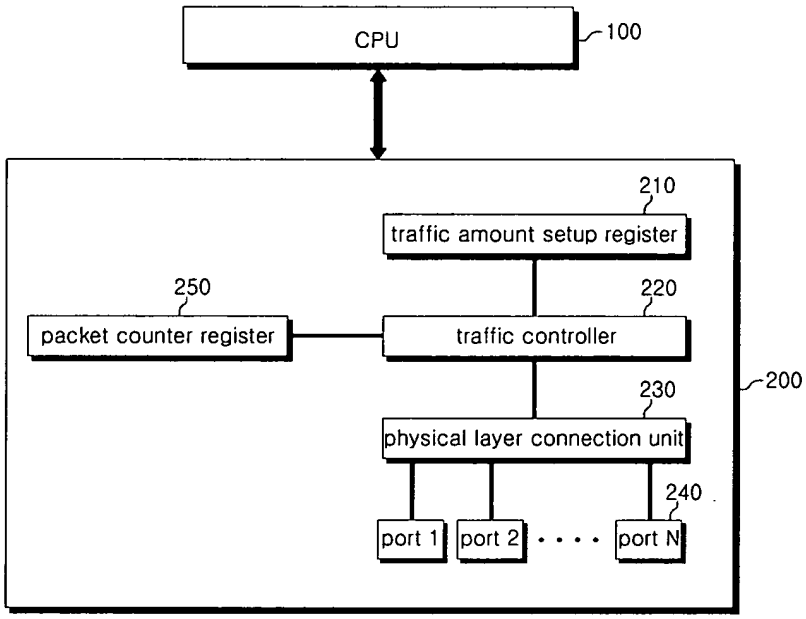
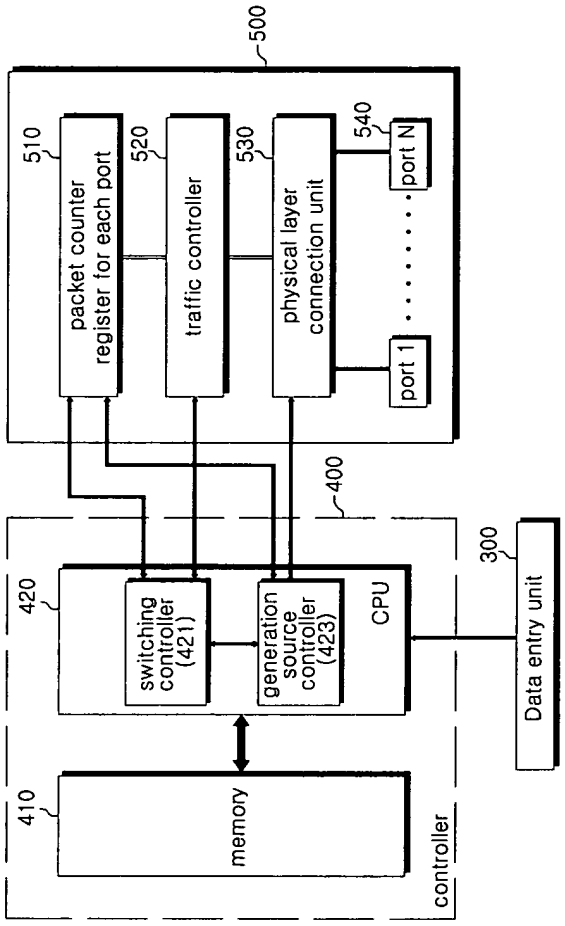

CPU
100
210
traffic amount setup register
250
220
packet counter register
traffic controller
200
230
physical layer connection unit
240
port 1
port 2
port N

Fig.2


500
510
packet counter register for each port
520
traffic controller
530
physical layer connection unit
540
port N
port 1
400
300
420
switching controller (421)
generation source controller (423)
CPU
Data entry unit
410
memory
controller